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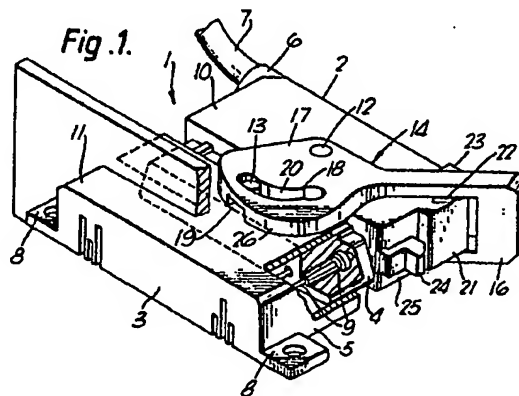
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(54) Electrical connector with stirrup lock

(57) A connector (1) with a stirrup lock has the stirrup (14), which is pivoted on one connector half (2), and can be locked in two end positions. In the uncoupled end position, the stirrup (14) is locked between a detent (22) and a step (23) located behind the detent. In this end position, the connector halves (2, 3) can be loosely fitted together without making contact until a stop (20) in the curved slot (18) of the pivoted plate (17) of the stirrup (14) is reached. By swivelling the stirrup (14) to the other end position, the connector halves (2, 3) are fully mated, with the stirrup (14) being releasably locked by means of a locking hook (24) formed on the housing of a connector half (2). When the connector halves are separated and the stirrup (14) is in the locked position, mating of the connector halves (2, 3) is not possible for reasons of safety.



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SPECIFICATION

Electrical connector

- 5 The present invention relates to an electrical connector comprising two parts which are mated and unmated by means of a stirrup lock.
- Such an electrical connector is disclosed in DE-AS 11 71 488. It consists of two housings each containing a contact strip and having a cable entry. One housing has a collar which receives part of the complementary housing when the two connector halves are mated. The housing of one of these connector halves, which can also be used separately, has connecting portions for attachment to stationary walls. Such connectors are used in electrical power engineering.
- DE-AS 10 29 900 discloses a multi-terminal connector for telecommunication equipment having blade contact strips attached to the rear side. During insertion of the equipment, the blade contact strips are placed into guides of a fixed rack and are brought into engagement with spring contact strips arranged in the rack. Due to the large number of separable electric connections, the guide must be of very precise design, and the subracks must always be pushed in vertically in relation to the rack. To guarantee this, the subracks have trunnions at their side walls which are each pivoted both in a guide slot of a fixed holding plate, which slot is perpendicular to the rack, and in a curved slot of a holding plate mounted parallel to the associated fixed plate and rotatable about a common axis, and which are movable in said slots via a linkage-like mechanism, so that if the rotatable plates on both sides are moved together by means of an inserted member, the subrack is movable parallel to itself in the slot perpendicular to the rack. Such an arrangement avoids any tilting of the subracks and permits the arrangement of a large number of blade contacts at one subrack.
- The invention seeks to provide a connector in which any unintentional contact and any accidental separation of contact elements is avoided.
- According to the invention there is provided an electrical connector comprising two connector halves, a stirrup lock having a stirrup which is pivoted on one connector half between two extreme positions and which is lockable in one extreme position for coupling the two halves, and a mutually engageable pivot and curved recess provided one on the stirrup and one on said other connector half which co-operate both to urge the connector halves together into contacting engagement or to effect their separation, wherein the stirrup is lockable in both extreme positions and, in said other extreme position the connector halves can be loosely fitted together without

engagement between contacts of the two halves.

- In order that the invention and its various other preferred features may be understood more easily, an embodiment thereof will now be described, by way of example only, with reference to the drawings, in which:

Figure 1 is a perspective cut-away view of two loosely joined connector halves with a stirrup locked in the uncoupled position, and Figure 2 is a perspective cut-away view of the connector of Figure 1 with the two halves fully mated and with the stirrup locked in the end position.

- In Figures 1 and 2, the electrical connector as a whole is designated by the reference numeral 1. It consists of two connector halves 2, 3 of flat design having a substantially rectangular cross-section. One connector half has a projection 4 at the front which, when the two connector halves are mated, is received by a corresponding collar 5 of the other connector half. In the described embodiment, one of the halves 2 of the connector 1 is designed as a flexible part and has an entry 6 for a connecting cable 7 at one of its end faces, whereas the other connector half 3 has lateral mounting portions 8.

- Contact elements 9 contained in the insulating bodies of the connector halves 2, 3 are designed as pin and socket contacts, the latter being advantageously accommodated in the projection 4. The pin portions of the contact elements 9 mounted in the insulating body of the other connector half 3 project freely into the space limited by the collar 5.

- The housing of each of the connector halves 2, 3, which are preferably injection-moulded plastic parts, has an integrally moulded pivot on each of its flat sides, the pivots of the connector half 2 serving as trunnions 12, and those of the other connector half 3 as locking pins 13. A stirrup 14, a one-piece plastic moulding, is snapped onto the trunnions 12.

- The stirrup 14 is a substantially U-shaped part, the bridge connecting the two legs 15 being designed as a handle portion 16 and the leg ends each being designed as pivoted plates 17. The pivoted plate 17 has either a hole for receiving the trunnion 12 or, as an alternative, has a pivot formed on the inside which engages a corresponding hole of the housing of the connector half 2. Furthermore, the pivoted plate 17 has a curved slot 18 and a straight insertion recess 19 ending at the end of the curved slot. The end of the insertion recess 19 limited by a side wall of the curved slot 18 forms a stop 20 for the locking pin 13.

- The stirrup 14, which is rotatable about the trunnions 12, has two defined end positions in which it is locked. Such locking mechanism consists of a relatively low detent 22 formed on at least one flat side 10 in the corner area between the front end 21 and the rear end of

the connector half 2 supporting the stirrup 14, and a stop 23 rising behind the detent 22. The distance between the detent 22 and the stop 23 is equal to the thickness of the leg of the stirrup 14, so that the stirrup 14, when pressed against the stop 23, is locked in this end position. The locking mechanism, of course, is located in that corner of the housing which is opposite the cable entry.

- 10 In another embodiment, a locking mechanism consisting of a detent 22 and a stop 23 is provided in each corner area of the housing on at least one flat side 10 of the connector half 2. Since the trunnions 12 and the locking pins 13 on the connector halves 2, 3 are arranged symmetrically, the entry 6 for the connecting cable 7 can be provided by optionally attaching the stirrup 14 to either the left or the right side of the housing.
- 20 In the locked position of the stirrup, the insertion recess 19 extends in the direction of insertion of the connector half 2 and essentially at right angles to the curved slot 18. To improve the mechanical stability of the pivoted plate 17, the insertion recess 19 is a groove formed on the inside and is slightly deeper than the length of the locking pin 13.

- To make the electric connection, the connector halves 2, 3 are first loosely fitted together until the locking pin 13 reaches the stop 20 in the curved path. In this position, the contact elements 9 of the connector halves 2, 3 do not make contact but still have a defined clearance. Only by pulling the handle portion 16 at the front end 21 of the housing to the other end position are the connector halves coupled completely, i.e. brought into complete mechanical and electrical engagement with each other, with relatively small operating forces. The coupled end position is achieved when the end of the curved slot 18 which is farthest from the stop 20 reaches the locking pin 13. In this position of the stirrup, a locking hook 24 previously deflected by the handle portion 16 has sprung back into its rest position in which it engages behind the handle portion 16 and locks the stirrup in this position. The locking hook 24 is formed on the front end 21 of the connector housing, preferably in a recess 25.

- By the locked position thus produced, accidental separation of the connector halves is avoided. For this reason, the locked position can only be unlocked intentionally with a simple tool, e.g. a screwdriver or a ballpoint pen. After the locking hook 24 has been pressed back, the connector halves 2, 3 are separated again when the stirrup 14 is moved back to its initial position. Favourable transmission ratios between the curved path and the leverage action require only small operating forces but cause the connector halves to be safely separated.

- As previously mentioned, the initial position is a locked position in which the stirrup 14

reaches the stop 23 of the connector housing in the opening direction. In the closing direction, the detent 22 prevents the stirrup 14 from performing a closing movement of its own. Furthermore, the detent 22 first of all requires a defined force to be applied before the stirrup 14 can be closed. The locking threshold is so chosen that the force used to surmount the stop 22 necessarily moves the stirrup 14 to the other end position. Should, however, an attempt be made to mate the connector halves 2, 3 when the stirrup 14 is not closed, such mating is prevented by the lower edge 26 of the pivoted plate 17, thus avoiding any unintentional contact between the contact elements 9.

If the connector 1 is used in the automotive industry, it is important for reasons of functional safety that the connector halves 2, 3 and their contact elements 9 either be mated safely, or that contact between the socket and pin contacts be impossible.

The position of the stirrup clearly indicates the plugged condition of the connector 1 in an advantageous manner. In order to avoid incomplete contact touch when the connector halves 2, 3 are loosely plugged but the stirrup is not in the locked end position, a return spring (not shown) which is fixed above the trunion 12 on the one hand and at the handle portion 16 on the other hand can be provided, such return spring automatically separating the connector halves in such a case. The return spring can be a leaf spring, for example.

- Although the embodiment described employs two curved slots 18 and pin 13 one on each side of the stirrup it will be appreciated that these need only be provided on one side.

- Although the embodiment described employs a recess/slot 18 in the stirrup and a pin 13 on the connector half 3, the opposite configuration is possible where the curved recess(es) is/are provided in the housing of the connector half 3 and the pin(s) on the stirrup. Such an arrangement is considered to fall within the scope of this invention.

CLAIMS

1. An electrical connector comprising two connector halves, a stirrup lock having a stirrup which is pivoted on one connector half between two extreme positions and which is lockable in one extreme position for coupling the two halves, and a mutually engageable pivot and curved recess provided one on the stirrup and one on said other connector half which co-operate both to urge the connector halves together into contacting engagement or to effect their separation, wherein the stirrup is lockable in both extreme positions and, in said other extreme position the connector halves can be loosely fitted together without engagement between contacts of the two halves.

2. A connector as claimed in claim 1,

wherein two said mutually engageable pivots and curved recesses are provided one on each side of the connector.

3. A connector as claimed in claim 1 or 2,
5 wherein the or each curved recess is formed by a curved slot provided in a pivot plate of the stirrup which co-operates with a pivot provided on said other connector half.

4. A connector as claimed in claim 3,
10 wherein a contact-preventing stop is formed by the end of an insertion recess in the pivoted plate of the stirrup.

5. A connector as claimed in claim 4,
15 wherein when the stirrup is locked in the uncoupled position, the insertion recess extends in the direction of insertion of the connector half carrying the stirrup.

6. A connector as claimed in claims 4 or 5,
20 wherein the insertion recess is formed on the inside of the pivoted plate.

7. A connector as claimed in any one of the preceding claims, wherein the stirrup is locked in the uncoupled extreme position by means of a detent located in front of a stop.

- 25 8. A connector as claimed in claim 7, wherein the stop and the detent are located on at least one flat side of the connector half supporting the stirrup and in at least one corner area between the front end and the rear end of said half.

- 30 9. A connector as claimed in any one of the preceding claims, wherein the locking of the stirrup in the coupled extreme position takes place automatically at the end of the pivoting movement.

- 35 10. A connector as claimed in any one of the preceding claims, wherein the stirrup is locked by means of a resilient locking hook engaging behind a handle portion of the stirrup.

- 40 11. A connector as claimed in any one of the preceding claims, wherein the stirrup is a one-piece plastic moulding.

- 45 12. A connector as claimed in any one of the preceding claims, wherein the stirrup and the connector half supporting it are interconnected via a return spring.

13. A connector as claimed in claim 12,
50 characterised in that the return spring is a leaf spring.

14. A connector substantially as described herein with reference to the drawings.